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(54) LIQUID DISPOSAL DEVICE

(71) We, CORNING LIMITED formerly JAMES A. JOBLING & COMPANY LIMITED, a British Company of Wear Glass Works, Sunderland, Co. Durham, do hereby declare the invention, for which we pray that a Patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to equipment for use in research work areas in training establishments such as laboratories, industrial research departments and medical research units. In the past such research work areas had fixed work benches frequently including sinks, and were provided with fixed installations of water and electricity and gas supplies as well as liquid waste pipes. Such work areas take up a lot of space in a building and frequently are unused as the students are in other rooms attending lectures for example. The high cost of building and maintaining such work areas has led to rendering the areas adaptable for other uses by having mobile work benches, since and the like which can be moved away by simple disconnection from service conduits and pipe lines; such service conduits and lines are however usually in the floor of the work area and when the work benches are moved the connections are above the floor hindering other activities in the areas as well as cleaning and sterilisation of the area.

In modern buildings the service supply lines are laid in the floors and have fixed water and like service lines from the ducts in the floors through breaks in the floor surfaces so that even if the work benches are sufficiently mobile to be removed, the covers to the floor breaks create irregular floor surfaces which are inconvenient. In older buildings adapted for laboratory work there are often no satisfactory drainage ducts so that installation becomes expensive and when carried out suffers from all the disadvantages of services laid in the floors.

More recently an overhead boom system has been employed in such areas, the boom being suspended below the ceiling of the work area but above the heads of personnel working in the area, and carrying conduits for electricity, gas and liquid supplies as required. The bottom system may include piping for the disposal of waste liquid from the floor above but these necessitate the waste piping having a substantial fall to permit waste liquid to flow by gravity to waste stack pipes whence it goes to the town drain. This is unsatisfactory because the pipes from the floor above have to be passed through holes broken through the floor and when the drain pipes are installed these have to be leak-sealed in the holes which is expensive and not satisfactory since it involves expensive alteration to the building and any leak which may occur is costly to eradicate. Moreover, it has been found difficult to provide suitable materials for such waste ducts since in chemical laboratories for example waste effluent is frequently corrosive. Glass is a suitable material but it is expensive to seal glass ducts in a leak proof manner in such building adaptations.

The main object of the present invention is to provide equipment for use with boom services with improved drainage from the work benches to an elevated boom waste pipe, in which the aforesaid disadvantages are reduced to an acceptable economic proposition to the building industry.

According to the present invention a power operated liquid waste disposal device for mobile laboratory sinks and like means comprises a portable frame supporting a liquid waste trap with an inlet incorporating filter means for liquid waste

from a sink or like outlet duct, a trap outlet for the liquid waste, a power driven pump with its intake connected to the trap outlet and its delivery duct connectable by a closed duct to an elevated boom drainage line, means to provide, for all operating conditions in the trap, a gas and liquid seal between the pump and the outlet from the sink or like means, a breather conduit connected to the trap to maintain an operating pressure within the trap, a power supply connection to the pump prime mover, and an automatic switch device operable by the liquid level in the trap to cause actuation of the pump prime mover to empty liquid from the trap between predetermined liquid levels therein.

The duct from the sink or like outlet to the waste disposal device and the duct connecting the trap outlet to the boom drainage line as well as the breather may incorporate or comprise flexible pipes, or rigid pipes e.g. of glass, connected into the disposal device by flexible joints.

From another aspect a portable work bench or like service apparatus including a liquid waste disposal device of the invention may be provided in which the work bench may be a portable stand having cavities to receive a sink, trough or the like the drainage outlet of which is connectible to a flexibe drainage duct, and if desired water supply taps and/or gas or electric taps or points connectible by flexible conduits to their respective supply lines in the boom. The work bench may incorporate other features such as a table top or shelves or cupboards, but this forms no part of the present invention and requires no further description herein.

An injection valve device may be provided for connection between the pump outlet and the boom drainage line, said device comprising a valve body mounted adjacent to the boom drainage line, a valve inlet connectible to the pump outlet to receive drainage effluent therefrom and an outlet connectible into the boom drainage line, preferably at the upper end thereof, in a direction which imparts to effluent injected under pressure by the liquid waste disposable device entering the drainage line a gyratory and longitudinal movement to the effluent as it enters the boom drainage line.

With such a construction a ventilation non-return valve is located in the boom drainage line to eliminate syphonage and to prevent the effluent being forced under pressure out of the vent. Such a valve is normally placed upstream of the last injection valve on an overhead drain line run. It may however be placed elsewhere in this run. It is also prevents drainage odours from entering the ambient laboratory atmosphere.

In order that the invention may be more fully understood an embodiment in accordance therewith will now be described by way of example with reference to the accompanying drawings, in which:

Fig. 1 shows diagrammatically an existing boom system for laboratory or like equipment but incorporating a boom drainage line;

Fig. 2 is a drawing on an enlarged scale of a power operated liquid waste disposal device for use with such a system; and,

Fig. 3 is a perspective view of a valve providing entry of the effluent from the liquid waste disposal device into the boom drainage live.

In the drawings, the same references are used to designate the same or similar parts.

Referring to Fig. 1 this shows the ceiling 1 of a laboratory or like room having mounted adjacent to it or on or in it a boom 2 containing supply lines 3 for such supplies as town gas, water, electricity and oxygen gas or other supplies. Each of these lines is connectable to mains supplies or for such supplies as oxygen gas to an oxygen gas accumulator which may be replaceable when exhausted. The boom also includes a drainage line 4 connectible to a down pipe or other effluent disposal line in or leading from the building in which the room is located.

Each of the supply lines 3 and the drainage line 4 has coupling connectors 5, 6 respectively to which the corresponding lines are coupled from or to a portable work bench 6a, and a liquid waste disposal device 7 of the invention to be described. Each of the boom line couplings may include a cock 8 by which they may be shut off when the flexible lines to them from the work bench and/or device 7 is disconnected therefrom.

The work bench is shown as a wheeled unit on supports 9 which can support on or under it a sink or like unit or it may have as shown cavities 10 in the upper framework 11 to receive removable sinks or troughs 12 with drainage outlets 13 or the troughs or sinks may be permanently incorporated in the bench. The bench may have one or more troughs or sinks as desired and these may be of plastics, glass or other suitable material. The bench may also have water supply taps 14 or gas taps or electricity supply points (not shown) permanently or temporarily mounted thereon and can if desired incorporate other features such as a table top or bench 15 or a cupboard 16. The water taps are shown connectible by suitable couplings to a flexible duct or hose 17 which is connected to the water supply line coupling 5

in the boom. Gas and electricity pipes and flexes or conduits are similarly connected to their boom lines. Additional supply means may be provided such as oxygen gas supplied from an accumulator in the building or outside the building through a boom line or the accumulator may be on a portable carriage or mounting or it may be supported in the work bench itself, if desired, and arranged to be removable therefrom.

Referring to Fig. 2, the liquid waste disposal device 7 is portable and although it is shown on feet 17 it may be on wheels for easy movement about the laboratory.

The device 7 has a frame shown as a base 18 preferably in the form of a trough as shown in Fig. 2, on which is mounted a chamber forming a trap 20 of material inert to the drainage liquid for example glass. This trap is shown as a cylinder closed by a cover 21 on which are an inlet 22 for drainage liquid, a trap breather 23, and a probe device 24 (to be described) for controlling the level of liquid in the trap. The trap may however be formed as an inverted vessel, e.g. have a domed end in which connections are provided for the aforesaid means for operation of the device 7. Such a trap is preferably of glass and it may be fabricated from several parts.

The trap inlet 22 has a coupling 25 to which an inlet adaptor 26 is connected, the adaptor being connected to a pipe, which may be flexible or rigid as of polytetrafluoroethylene, polypropylene or glass, or a bellows hose 27 the other end of which is connected to the drain outlet 27*a* of the sink or trough 27*b* on the work bench. Each of these couplings is of conventional form such as a plastics screw cap. The couplings may be of any suitable material such for example as are used in coupling glass pipes end to end. In Fig. 2 two sinks or troughs 27*b* are shown with their drainage hoses 27 connected to the adaptor 26 which in this case is of T-shape but any convenient number of hoses may be connected to a multi-branch adaptor. The liquid flows from the sinks or troughs into the trap by gravity or it may be syphoned out of the sinks or troughs into the trap. The drainage effluent is usually cold and acts as a coolant for the mechanical seal of the pump. However the system can accept a hot drainage effluent should that be necessary.

The base has mounted thereon a pump 30 which may be of glass or other suitable material e.g. polytetrafluoroethylene or polypropylene driven by a prime mover shown as an electric motor 3 the electric supply conduit 32 for which is mounted in the base leading to a suitable socket and plug connection 33 which in turn is temporarily connected by a flexible conduit 34 to the electricity supply line in the boom.

The pump inlet 35 is connected by a coupling to the outlet 37 from the trap and the pump outlet is connected to a rising disposal line shown as a flexible hose 38 e.g. of polytetrafluorethylene or polypropylene or it may be a glass pipe and is in turn temporarily connected to the drain line 4 in the boom.

In Fig. 2 the pump outlet 30*a* is shown as leading upwardly into the tube 30*b* of larger diameter than the outlet 30*a* and at its upper end it is connected to the rising drainage liquid disposal line 38. It will be observed that the top of the tube 30*b* is as high as the interior of the chamber forming the trap 20 so that it accommodates the liquid level therein up to the maximum height of the liquid in the chamber at which the pump is switched on by the probe system. Thus the tube 30*b* contains liquid which falls back when the pump is idle thus providing a liquid seal of the pump and sufficient liquid to prime the pump for its next cycle of operation. The tube 30*b* may be omitted and the line 38 is then connected directly to the pump outlet only if the liquid disposal hose has no bends, in which the liquid can lie stagnantly, or it must be composed of material resistant to the effluent.

A breather line 23 is connected to the top of the trap and the open free end is directed into the boom as shown in Fig. 1 or it may be led back into the sink as if foam were present, this could be discharged through an atmospheric opening and it would be unpleasant if not directed into the sink. This breather line maintains the desired pressure, usually atmospheric, in the trap but where the line 23 is connected into the boom it will be at the pressure within the boom which may be above atmospheric pressure.

The adaptor 26 has integral with it or connected to it a pipe 40 extending down into the trap and this has slots 41 in it shown as vertical but they may be horizontal or otherwise arrayed. These slots are of a width and in sufficient number to ensure free flow of liquid into the trap from the connector 26 but so as to prevent any debris such as glass chips, buttons or ciggarette ends entering the trap. Such foreign objects will collect in the bottom of the pipe 40 which is closed but may open into the trough 18 and it may be emptied from time to time by removing it from the trap or a removeable cap or plug may be provided in the lower end of the pipe 40 for this purpose. The bottom of the trap may also form a sump into which the pipe 40 open at its lower end, and although the movement of liquid in the trap during fil-

ling causes turbulence in liquid, the sump is preferably deep enough to be below the turbulent liquid so that foreign bodies which pass the filter can settle in the sump.

The trap also has the probe device 24 connected to its upper end. This device has a probe 51 extending down to near the bottom of the trap, a second probe 52 extending to just above the lower end of the probe 51 and a third probe 53 extending only a short distance into the top of the trap. The probes have electrically insulated exteriors as with polytetrafluoroethylene sheathing with a core of electrically conducting material connected to a tip at the end of each probe e.g. of platinum, but the probes must be chemically inert to materials being drained. The probe 51 is the return electricity lead, and the probes 52, 53 are connected to an electric power supply through a conduit 54, and a supply lead at a relay and control module 55 on the base. The voltage and current on the probes is minimal and merely has to be sufficient to operate the relay. The liquid in the trap when covering the probes completes the electric circuit between the probes.

The probe device is of known construction and functions as follows: when the liquid flows into the empty trap, the rising liquid when it touches the probe 53 will complete the electric circuit to the relay which switches the motor 31 on and off and causes it to drive the pump which empties the liquid from the trap between the probes 53 and 52 and when the liquid level falls below the probe 52 the circuit through the liquid is broken and the pump ceases to operate. There is thus always a liquid seal between the pump 30 and the sinks 27*b* or the like.

The lower end of the probe 51 is above the top of the pump inlet 35 so that the pump when operating with liquid is always full and thus is self priming. However, the effluent waste may be either in the form of foam or of substances which foam under the conditions of turbulence created in the trap: should this occur it could happen that the liquid level in the trap drops below the pump inlet while foam above the liquid completes the electric circuit between the probes 52, 51 and the pump runs empty. Although foam may remain in the trap for some time and complete the circuit for pump operation, it eventually dissipates and the pump is de-energised. The lubrication and cooling effect of the foam prevents pump failure due to seal overheating. While the probe device 24 has been described, other level detection means may be employed such as a magnetic float switch or a pressure sensitive device responsive to a head of a few inches of water, or a like sensitive device incorporating a photo-electric means controlling the electric current supply to the motor 31.

The flexible hose from the pump outlet is connected into the boom drain line through the valve device 6 (Fig. 3). The boom drainage line may be of glass. The valve device as seen in Fig. 3 is preferably of glass and is supported by a rod or pipe 61 from the boom, or from the drainage line if that is separate from the boom. The device has an inlet tube 62 connected by a coupling to the pump delivery hose and an outlet 63 connected to the boom drain line, a valve 64 being provided to close the access to the boom drain line when the flexible connector is disconnected. The outlet 63 is connected into the upper portion of the boom at an oblique angle thereto so that it imparts turbulence to the liquid with both a longitudinal component towards the drain outlet and a rotary motion to the liquid in the boom drain line causing the liquid to be rapidly and turbulently driven along the boom line to waste. The valve 64 may be of any suitable make such as that marketed under the Trade Mark ROTAFLOW.

The device 7 of the invention not only enables the liquid waste to be removed by lifting it to the boom, but provides a self contained disposal device which can be removed from the work area, after disconnection of the supply and drainage lines from the boom.

WHAT WE CLAIM IS:—

1 A power operated liquid waste disposal device for mobile laboratory sinks and like means comprising a portable frame supporting a liquid waste trap with an inlet incorporating filter means for liquid waste from a sink or like outlet duct, a trap outlet for the liquid waste, a power driven pump with its intake connected to the trap outlet and its delivery duct connectable by a closed duct to an elevated boom drainage line, means to provide, for all operating conditions in the trap, a gas and liquid seal between the pump and the outlet from the sink or like means, a breather conduit connected to the trap to maintain an operating pressure within the trap, a power supply connection to the pump prime mover, and an automatic switch device operable by the liquid level in the trap to cause actuation of the pump prime mover to empty liquid from the trap between predetermined liquid levels therein.

2. A device according to claim 1 wherein the duct from the sink or like outlet to the waste disposal device and the duct connecting the trap outlet to the boom drainage line as well as the breather

incorporate or comprise flexible pipes, or rigid pipes e.g. of glass, connected into the disposal device and parts of the disposal device by flexible joints.

3. A liquid waste disposal device according to claims 1 or 2 wherein the automatic switch device is associated with a first probe device extending down to near the bottom of the trap, a second probe extending down to a point above the lower end of the first probe, and a third probe extending into the top of the trap, the probes having at their lower ends exposed electrically conducting elements inert to the material being drained and connected to an electric circuit which includes means to energise the pump motor whereby the liquid level in the trap is maintained between the first and third probes.

4. A portable work bench or the like service apparatus including a liquid waste disposal device according to any of claims 1 to 3 wherein the work bench is a portable stand having cavities to receive a sink, trough or the like the drainage outlet of which is connectible to a flexible drainage duct, and if desired water supply taps and/or gas or electric taps or points connectible by flexible conduits to their respective supply lines in the boom.

5. A service apparatus according to claim 4 wherein one or more of the supply and drainage lines includes a switch or cock for disconnection of the line when the flexible lines are disconnected therefrom.

6. An apparatus according to claim 4 or 5 wherein the work bench is a wheeled unit for disposition beneath the sink unit or units or to receive or support the sink unit or units.

7. An apparatus according to any of claims 3 to 6 wherein the bench incorporates one or more sink or trough units.

8. An apparatus according to claim 6 or 7 wherein the sink or trough units have permanently or detachably connected thereto cocks, taps or switches for connection of water, gas and/or electricity supply lines to the boom.

9. An apparatus according to any of claims 4 to 8 wherein an injection valve device is provided for connection between the pump outlet and the boom drainage line, said valve comprising a valve body mounted adjacent to the boom drainage line, a valve inlet connectible to the pump outlet to receive drainage effluent therefrom and an outlet connectible into the boom drainage line in a direction which imparts to effluent injected under pressure by the liquid waste disposal device entering the drainage line a gyratory and longitudinal movement to the effluent as it enters the boom drainage line.

10. A power operated liquid waste disposal device according to claim 1 substantially as herein described with reference to Fig. 2.

11. A portable bench or service apparatus substantially as herein described with reference to Figs 1 to 3 of the accompanying drawings.

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1 472 857 COMPLETE SPECIFICATION
3 SHEETS

This drawing is a reproduction of the Original on a reduced scale.
SHEET 1

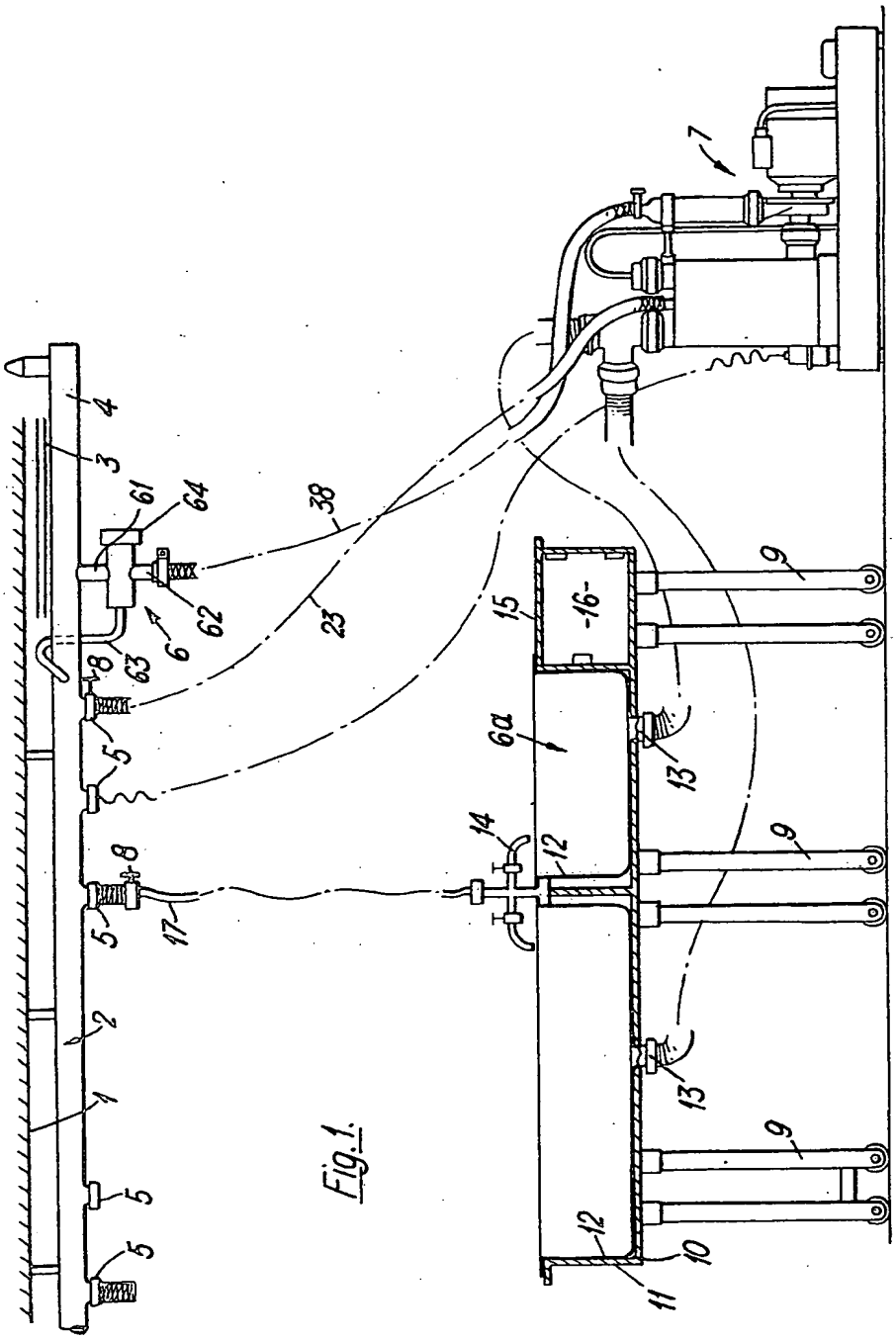

Fig. 1.

1 472 857 COMPLETE SPECIFICATION
3 SHEETS
This drawing is a reproduction of the Original on a reduced scale.
SHEET 2

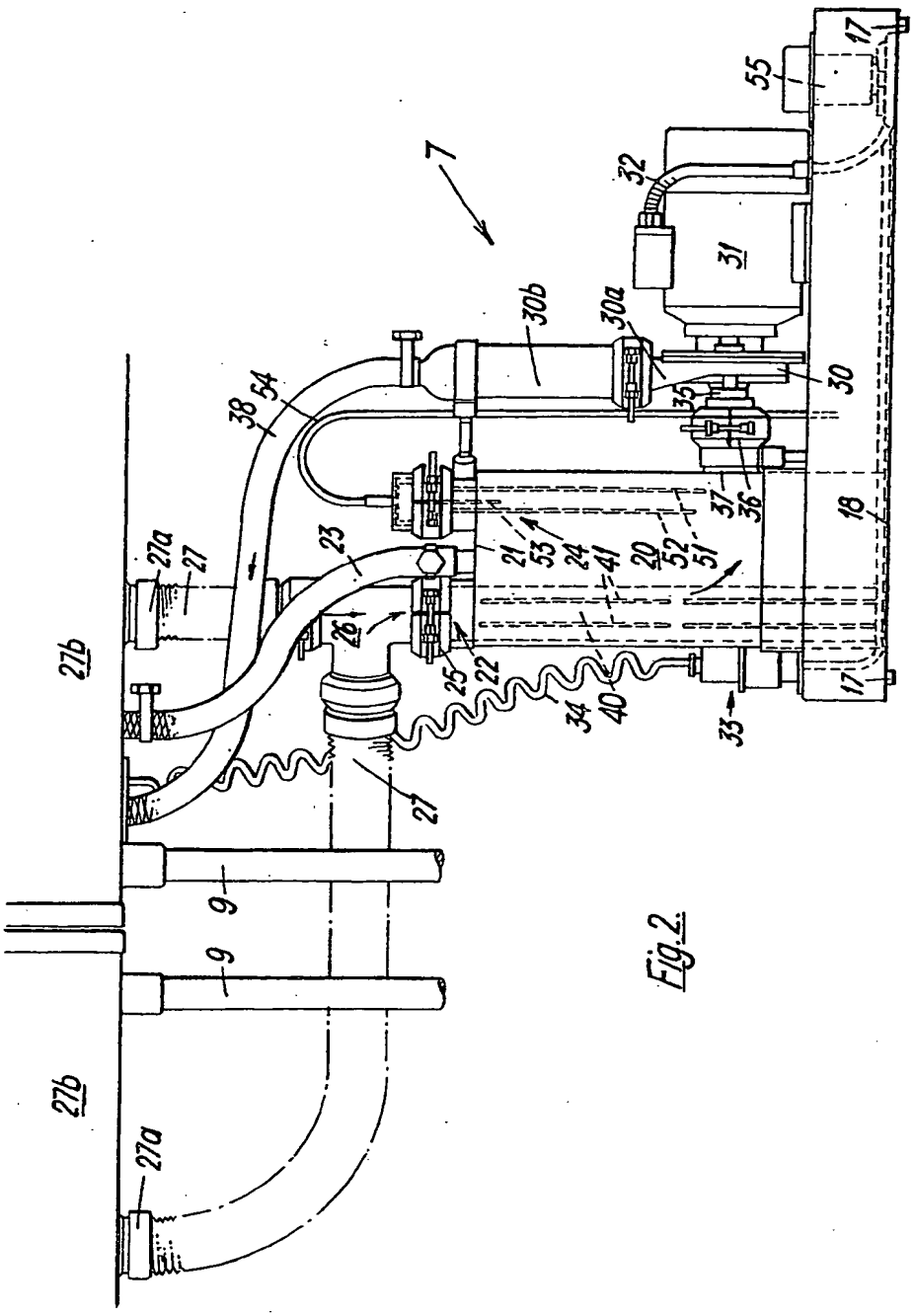

Fig.2.

1472 857
3 SHEETS

COMPLETE SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale.

SHEET 3

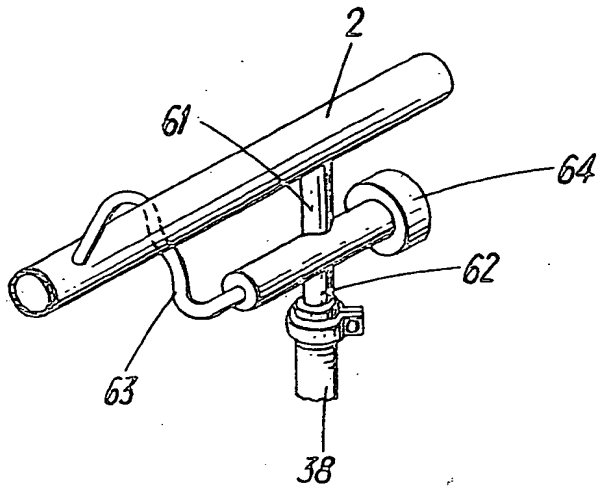

Fig.3.